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FACILITATING THE DESIGN SPECIFICATION AND ORDERING FROM A MANUFACTURER OF A PARTICULAR DISPLAY PRODUCT

CROSS REFERENCE TO RELATED APPLICATIONS

Reference is made to commonly assigned U.S. Patent Application Serial No. 10/021,410 filed December 12, 2001 by Bradley A. Phillips et al., entitled "Apparatus for Permitting Transfer of Organic Material From a Donor to Form a Layer in an OLED Device", and commonly assigned U.S. Patent Application Serial No. __________ filed __________ by Andrea S. Rivers et al., entitled "__________", the disclosures of which are herein incorporated by reference.

FIELD OF THE INVENTION

The present invention relates to a system for and method of making display product design and manufacturing more cost efficient by optimizing the design data management process. More specifically, the invention is a system for and method of providing design analysis and data conversion based on real-world manufacturing capabilities in a networked computer application that is accessible to both display product designers and manufacturers. A number of example applications of this system are disclosed.

BACKGROUND OF THE INVENTION

As the use and demand of display products, in particular OLED displays, increases, the need for effective manufacturing of display product designs also increases. As the computer industry has continued to expand over the last several decades, techniques and tools for the design and assembly of electronic products made in high volume have become more automated. Conventionally, during the design stage of electronic products, a number of computer-aided design (CAD) tools can be used to assist in the electrical and mechanical design of the product. Once the design is complete, a number of computer-aided manufacturing (CAM) tools and robots are generally employed in the manufacture of the product.

A widely understood problem in using CAD and CAM tools to create a finished product is that the data stored in and used by the CAD systems is

not the same data that must be stored in or used by the CAM and/or assembly systems. There is substantial design-related data used in the CAD system that is unnecessary for the manufacturing of the product, and there is also data that is critical to the assembly of the product that is not used or generated by the CAD system. In addition, data and numerical formats, reference axes, fiducial marks, and the like, are often different in the CAD system than in the CAM/factory automation system. Older conventional methods have addressed these problems by transferring data between the CAD systems and the manufacturing operation via a hard copy that has been interpreted and annotated by a human. The CAD system produces hard copy drawings of the product to be built and then those drawings are given to the manufacturing engineers. The manufacturing engineers, looking at the CAD drawings, ignore the details extraneous to building the product and add other information. If automated equipment is used in the manufacturing line, the automated equipment is generally programmed manually by a technician reading the CAD drawings. The more advanced CAD/CAM systems automatically convert CAD data to CAM data to generate manufacturing automation programming. These conversion systems are typically based on the ideal performance of the targeted automation equipment and do not take into account real-world process limitations.

For designers and marketers of any product, the product design processes required to meet manufacturability constraints is costly. A range of processes for submitting product designs to manufacturers exists. The most rudimentary processes involve customers submitting paper specifications for a product that meets their specifications to manufacturers, who subsequently compare submitted product specifications to the rules regarding what can actually be made with the equipment the manufacturer has. Modern design processes utilize computerized design rule check (DRC) programs to validate product specifications before sending them to manufacturers.

However, regardless of where in the range of these processes that any particular customer-manufacturer relationship falls, a variety of real-world limitations are seldom included in these known design rules. These real-world

limitations often require product designers to modify and re-submit specifications to meet rules that they did not know exist, or can even render their designs unmanufacturable. In addition, a cost of manufacture savings may be possible if a customer were able to obtain information, which enabled them to choose a manufacturing site with the appropriate level of manufacturing capability. Thus, a need exists to make the process of submitting realistic product designs more cost efficient.

For product manufacturers, the process of reviewing specifications from product designers is costly. Many designs are submitted and reviewed that do not meet basic criteria, including incomplete submissions and submissions for products that require unavailable manufacturing equipment. The process of reviewing product specifications and requesting modifications from product designers is costly. Thus, a need exists to make the process of reviewing product specifications more cost efficient.

Another barrier to automating the transfer of CAD files to CAM systems is keeping the capability data and design rules current. This data changes as a result of: (1) changes on the design side related to product updates; (2) changes on the manufacturer side related to equipment age, processing techniques, supplies, etc.; and 3) basic changes to the technology. If both customer and manufacturer are not using the same data set, expensive inefficiencies are introduced to the process. Therefore, a need exists to keep design and manufacturing rules synchronized between product designers and manufacturers.

European Patent No. 1 003 087 A1 describes a method whereby the data to be transferred between the design system (CAD) and the manufacturing system (CAM) includes relative information as to the geometry of the object to be manufactured. The method defines certain parts at least of the object's geometry by: accessing a first library of the design system (CAD); selecting at least a pre-defined article in the first library; importing references for the article into the definition file of the object in the design system; transferring from the definition file from the design system (CAD) to the manufacturing system by identifying the article by reference; accessing a second library associated with the manufacturing

system and manufacturing data selection as a function of references corresponding to those of the article in the definition file; and importing manufacturing data into the manufacturing file for the object. While this invention creates a database system for design and data conversion rules, it does not provide for the inclusion of machine-specific manufacturing capability data in real time.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to make the process of designing manufacturable display products more cost efficient.

It is another object of this invention to make the process of design analysis, such as design rule checking, more effective.

It is yet another object of this invention to keep design and manufacturing data dependencies synchronized between product designers and manufacturers.

It is yet another object of this invention to permit real-time updates to manufacturing capability data.

This object is achieved by a method of facilitating the design specification and ordering from a manufacturer of a particular display product which is desired by a product designer, comprising:

a) the product designer providing design information for a particular desired display product to a service provider;

b) one or more display product manufacturers providing current manufacturing information including current manufacturing parametric data;

c) the service provider analyzing the design information and, based upon current manufacturing information received from one or more display product manufacturers, providing suggested design changes or design approval; and

d) the product designer providing a payment to the service provider for services rendered.

ADVANTAGES

A service provider as described herein offers several distinct advantages over conventional design data management systems. They include accurate, cost-effective design analysis, by basing the analysis processes on actual performance data, the quality and accuracy of the analysis is greatly improved; real-time updating of critical parameters, the centralized capability database can be updated in real time on a machine-by-machine basis from data provided by manufacturers; and centralized control of critical data, software architecture provides for a centralized control of the capability data, permitting greater security, consistency, and accuracy. In addition, the difficult task of synchronizing design and manufacturing changes is greatly simplified, and centralized control permits for development of revenue generation processes via database and analysis/conversion tool access control.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a system for facilitating the design specification and ordering from a manufacturer of a particular display product that is desired by a product designer;

FIG. 2 is a block diagram of a system data flow for design data management;

FIG. 3 is a block diagram of a system topology for design data management;

FIG. 4 is a block diagram of a software architecture for design data management;

FIG. 5 is a flow chart showing a method for facilitating the design specification and ordering from a manufacturer of a particular display product that is desired by a product designer;

FIG. 6 is a flow chart showing a method of performing a design rule check; and

FIG. 7 is a flow chart showing an alternate method of performing a design rule check.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is a system for and method of providing design analysis and data conversion based on real-world manufacturing capabilities in a networked computer application that is accessible to both product designers and manufacturers. A number of example applications of this system are disclosed. The method was developed for and is applicable for a display product design, e.g. an organic light-emitting diode (OLED) product, and manufacturing process in which it is desirable that design information (e.g., a CAD file) be analyzed using product or technology capability parameters to determine if the specified product can be manufactured.

Turning now to FIG. 1, there is shown a block diagram of a system for facilitating the design specification and ordering from a manufacturer of a particular display product that is desired by a product designer. A product designer, located at designer location **10**, designs a display to be manufactured in a manufacturing facility, e.g. manufacturing location **80**. A service provider is located at service provider location **40**. Designer location **10**, service provider location **40**, and manufacturing location **80** can be the same or different locations, providing that all locations are connected by communication channels, such as channels **30** and **35**, which can be e.g. LAN, WAN, ISDN, ATM, PSTN, dial-up connection, intranet, the Internet, or another type of network, and which can be open communication channels or secure channels as needed. Design location **10** includes a workstation or computer **15** that is connected to the network via modem **25**. A product designer can create a design **20** of a display device, for example by use of a computer-aided design (CAD) program. The design information can be sent from designer location **10** to the service provider at service provider location **40** via channel **30**.

Manufacturing location **80** includes one or more display manufacturing apparatus **70**. Display manufacturing apparatus **70** can be e.g. an apparatus such as described in commonly assigned U.S. Patent Application Serial No. 10/021,410 filed December 12, 2001 by Bradley A. Phillips et al., entitled "Apparatus for Permitting Transfer of Organic Material From a Donor to Form a

Layer in an OLED Device", the disclosure of which is herein incorporated by reference. A radiation source **65**, which can be e.g. a laser, can be used in manufacturing display devices, as described by Phillips et al., and can be controlled and monitored by computer **55** via connection **75**. Computer **55** can also be connected to metrology equipment (not shown), which can evaluate the performance of display manufacturing apparatus **70**. Computer **55** can be connected via modem **60** and channel **35** to service provider location **40**. Current manufacturing information can thus be provided to the service provider at service provider location **40**.

Service provider location **40** includes computer **45** that is connected via modem **50** to a network (channels **30** and **35**) for communicating with designer location **10** and manufacturing location **80**. The service provider can be fully automated, e.g. computer **45**, or can include human interaction.

FIG. 2 is a block diagram of a system data flow **100** that includes a product designer **120**, a quantity of data **125**, a quantity of data **130**, a service provider **110** that can be a design management system, a quantity of data **145**, a quantity of data **150**, and a display product manufacturer **140**.

Product designer **120** is an entity that produces design data or design specifications for display products intended to be manufactured. The design data is typically in the form of a CAD file, but can be in any format suitable for automated processing.

Data **125** includes design information for a particular desired display product that a product designer **120** provides to a service provider **110**. Such design information can be provided over a secure channel if desired. The design information can include CAD information, design specification files, requirements files, local design analysis results (e.g. design rule checking), proposed outline specification including form fit and function information, or any other data generated by product designer **120** intended for analysis, conversion, or management by service provider **110**. The proposed outline specification can include CAD information furnished over a secure channel. By form fit and function information, we mean information sufficient to specify a part, collection

of parts, or device that is electrically and mechanically compatible with a design and will perform the desired function.

Data **125** can also include information by which product designer **120** provides a payment to the service provider **110** for services rendered. For example, product designer **120** can specify an account that is to be charged for making payment for services rendered.

Data **145** includes manufacturing information, which can include current manufacturing parametric data. Such manufacturing information can be provided over a secure channel if desired, and can include current cost data, current diagnostic data, current manufacturability data, or combinations thereof. Manufacturing information can further include current equipment classes/types and/or current diagnostic data, diagnostic requests, and current manufacturing availability information. Diagnostic data, collected for a machine or process, is captured while running a diagnostic, as opposed to the manufacture of actual components.

Current manufacturing parametric data can include control charts, process capability data, process yields, and design rule limits. Data **145** includes the current state or most recent state of the manufacturing parametric data, for example performance over the past six months, preferably three months, or most preferably over the past month.

Data **145** can also include information by which product manufacturer **140** provides a payment to the service provider **110**, e.g. in the case wherein product manufacturer **140** is selected by product designer **120**.

Data **130** includes remote design analysis results, software updates, and any requested or required data from service provider **110**. Remote design analysis results include go/no-go decisions, error files, design requirements analysis, supplier capability matching, cost/design tradeoffs, and product performance estimations. Data **130** can also include suggested design changes, suggested manufacturers, cost information, delivery information, display product performance information, or combinations thereof. Data **130** can also include

communication by the service provider **110** with product designer **120** to obtain information needed to provide an effective reply to the product designer **120**.

Data **150** includes CAM data. Data **150** can also include communication by the service provider **110** with product manufacturer **140** to obtain information needed to provide an effective reply to product designer **120**.

Although both FIG. 1 and FIG. 2 show a single manufacturing location **80** and display product manufacturer **140**, respectively, it will be understood that the method described herein can also be performed with a plurality of display product manufacturers **140**.

Service provider **110** performs a set of automated processes and associated hardware for processing data transfer and management requests from product designer **120** and product manufacturer **140**. Service provider **110** is discussed in more detail in FIG. 3 and FIG. 4.

FIG. 3 is a block diagram of a design management system topology **200**, including the elements of a plurality of client computers **(210a** and **210n)**, a network **220**, and a design management host **230**. Design management host **230** further includes a Web server **232**, an application server **234**, and a database server **236**.

Client computers **(210a** and **210n)** are typically personal computers or workstations resident in either product designer **120** or product manufacturer **140**. Client computers **(210a** and **210n)** have the ability to transmit and receive data over network **220**.

Network **220** is a communications network, such as a LAN, WAN, ISDN, ATM, PSTN dial-up connection, intranet, or the Internet.

Design management host **230** is a hardware system for executing the functions of service provider **110**. Design management host **230** can be physically located on one or more servers, according to the specific requirements of design management system topology **200**. Design management host **230** can be physically co-located or distributed in any conventional distributed computing architecture.

Web server **232** is a server application that provides World Wide Web services, and can reside on multiple physical servers. Web server **232** handles all HTTP requests from client computers (**210a** and **210n**), and sends requests for data to application server **234** to be displayed on client computers (**210a** and **210n**).

Application server **234** is a server application that provides support for whatever applications are required by design management host **230**, and can reside on multiple physical servers. Application server **234** implements a portion of the business logic and rules for design management system topology **200**; the remainder of the business logic and rules are implemented by the database system in database server **236**. Minimally, application server **234** performs five functions: (1) manages forms for data entry and display; (2) stores attachments; (3) processes e-mail related to the applications; (4) processes queries; and (5) provides a reporting tool.

Database server **236** is a server application that supports and maintains tables or other data structures according to the specific architectural needs of design management system topology **200**. Minimally, database server **236** provides a relational database management system (DBMS). Database server **236** maintains and stores a variety of transaction information, which is served back to client computers (**210a** and **210n**) via network **220**.

In one specific example, Web server **232**, application server **234**, and database server **236** are all installed onto one physical server.

In another specific example, Web server **232**, application server **234**, and database server **236** reside on separate server computers.

In operation, client computers (**210a** and **210n**) input, store, process, and output information in a conventional manner.

In one preferred embodiment, product designer **120** launches Web browser software installed on client computers (**210a** and **210n**). Web browser software displays a user interface comprised of Web pages provided by Web server **232**. For example, the user interface is customized for product designers **120** submitting product design information. Product designer **120** can use the user

interface to select a CAD file containing product specifications for processing by software resident on application server **234**. Product specifications are transmitted from client computers (**210a** and **210n**) across network **220** and are stored in design management host **230**. Subsequent processing steps are described below. In another example, instead of inputting a CAD file, customer inputs a structured data file containing all required product parameters.

Service provider **110** provides design analysis and data conversion that takes into account real-world manufacturing limitations and variability. Key to that characteristic is the availability of real-time process capability information.

FIG. 4 is a block diagram of a software architecture **300** for design data management, which provides for a database that tracks common process capability. Software architecture **300** includes an analysis process **310**, a conversion process **330**, a network **350**, and a capability database **360**.

Analysis process **310** further includes a design data analysis application **315** and a capability matrix table **320**. In one example (described in detail below in reference to FIG. 4), analysis process **310** is contained within application server **234**. In another example (described in detail below in reference to FIG. 5), analysis process **310** is contained within software installed on client computers (**210a** and **210n**).

Conversion process **330** further includes a design data conversion application **335** and a capability matrix table **340**.

Network **350** is a data communications network, like network **220** described above.

Capability database **360** is a relational database that accesses parameters for manufacturing and technology capabilities. Capability database **360** is contained within database server **236**.

In operation, analysis process **310** receives a request to process some manner of design data (not shown). As part of processing this request, certain manufacturing or technology capability indexes are identified. A request for these capability indexes is sent through network **350**, and the capability indexes are used to search capability database **360** and to build capability matrix

table **320**. Design data analysis application **315** (e.g., a design rule checker) uses capability matrix table **320** to define analysis parameters for processing the design data.

Conversion process **330**, design data conversion application **335**, and capability matrix table **340** operate in a similar fashion to analysis process **310**, design data analysis application **315**, and capability matrix table **320**, respectively.

Software architecture **300** is independent of the type or locality of the supporting hardware. Analysis process **310**, conversion process **330**, and capability database **360** can be co-resident on the same computer or resident on separate computers.

In a preferred embodiment, analysis process **310** and conversion process **330** are designed in such a way that they cannot operate without a valid capability matrix table. Validity can be determined in any of a variety of ways, including, but not limited to: date code, cyclic redundancy check (CRC), password protection, or file source.

Turning now to FIG. 5, and also referring to FIG. 2, there is shown a flow chart showing a method for facilitating the design specification and ordering from a manufacturer of a particular display product that is desired by a product designer **120**. At the start (step **365**), a product designer **120** provides design information via data **125** for a particular desired display product to a service provider **110** (step **370**). If desired, the design information can be provided over a secure channel. One or more display product manufacturers **140** provide manufacturing information via data **145** including current manufacturing parametric data to the same service provider **110** (step **375**). The manufacturing information can include the data and information described above for data **145**. If desired, the manufacturing information can be provided over a secure channel, which can be the same secure channel as used for the design information, or can be a different secure channel. Step **375** can precede, succeed, or be simultaneous with step **370**. The service provider **110** then analyzes the design information provided by the product designer **120** (step **380**).

If the information provided by product designer **120** is insufficient to provide an effective reply to product designer **120** (step **382**), the service provider **110** can optionally communicate with the product designer **120** via data **130** to obtain information needed to provide an effective reply to product designer **120** (step **372**). If necessary, the iterative cycle of providing information (step **370**), analyzing the information (step **380**), and communicating to request further information (step **372**) can be repeated.

If the information provided by product manufacturer **140** is insufficient to provide an effective reply to product designer **120** (step **383**), the service provider **110** can optionally communicate with the one or more product manufacturers **140** via data **150** to obtain information needed to provide an effective reply to product designer **120** (step **377**). If necessary, the iterative cycle of providing information (step **375**), analyzing the information (step **380**), and communicating to request further information (step **377**) can be repeated.

If the provided information is sufficient, there is no need for further communications with the product designer **120** and product manufacturer(s) **140** for the purpose of requesting additional information. Based upon current manufacturing information received from one or more display product manufacturers **140**, the service provider **110** provides via data **130** suggested design changes (or design approval, if no changes are necessary) to the product designer **120** (step **385**). The service provider **110** can further provide suggested manufacturers based upon the analysis, or cost information, or delivery information, or display product performance information, or combinations thereof. The product designer **120** then provides a payment to the service provider **110** for services rendered (step **390**), e.g. product designer **120** can specify in data **125** an account which is to be charged for making payment to service provider **110** for services rendered, after which the process ends (step **395**). Additional optional steps that are not shown are also possible. For example, a product manufacturer **140** that is selected by product designer **120** can provide a payment to service provider **110**.

The following two figures show in greater detail the process by which service provider **110** analyzes the design information.

FIG. 6 is a flow chart showing a method **400** of performing a design rule check that is an example of executing analysis process **310**. In this particular example, analysis process **310** takes the form of a design rule checker. Method **400** shows a case in which capability matrix table **320** is created "on the fly" for the application, including the steps below.

In step 410, product designer **120** requests access to design rule checking applications from service provider **110**.

In decision step 420, a determination is made as to whether a system operator is an authorized user of the systems of service provider **110**. In one example, this authentication is done with conventional username and password authentication where a user logon form is transmitted to client computers (**210a** and **210n**) from design management host **230**. The combination of username and password is compared to the file of valid usernames and passwords stored in design management host **230**. If the username and password combination submitted by the system operator matches a known valid combination in design management host **230**, method **400** proceeds to step **430**. If the username password combination submitted by system operator cannot be found (e.g., after three attempts), method **400** ends.

In step 430, product designer **120** submits design data for design rule checking to ensure that the product specified can be manufactured. In one example, the product specification file is a CAD file. In another example, the product specification file is a structured data set. The product specification file is transmitted by network **220** and stored by design management host **230**, (e.g., in application server **234**) for subsequent analysis.

In step 440, capability matrix table **320** is created by database server **236** in design management host **230** and is populated with at least three types of data, namely: (1) current data regarding product design rules; (2) manufacturing equipment machine classes; and (3) performance data regarding the manufacturing equipment of participating manufacturers. In this example, design

data analysis application **315** differs from conventional DRC methods in that it incorporates the manufacturing equipment performance data. In one example, after a product design has been submitted, design management host **230** sends request(s) via network **220** to a plurality of client computers (**210a** and **210n**) (of product manufacturers **140**) that contain these data sets. In this example, each product manufacturer **140** provides current data regarding one or more of the three types of data described above via client computers (**210a** and **210n**) that is accessible by design management host **230**. This data from product manufacturers **140** is stored in capability database **360**.

In step 450, the design data submitted in step **430** is analyzed using parameters contained in capability matrix table **320**, which was populated in step **440**. If the design data satisfy the conditions defined by capability matrix table **320**, method **400** proceeds to step **470**; if not, method **400** proceeds to step **460**.

In step 460, error details regarding product specifications are sent to product designer **120** from design management host **230** via network **220**. These error details are generated as a result of running the product design against the design rule checker. The error details that are sent to product designer **120** generally include information to permit product designer **120** to quickly find design errors and plainly identify the action necessary to correct them. In a more specific example, potential errors include issues related to any of the following areas, including but not limited to: DRC compilation, constraint violations, incomplete or incorrect definitions, incompatible device properties, incompatible layer properties, and syntax. Method **400** then ends.

In step 470, additional information regarding product specifications is sent from design management host **230** via network **220**. In one example, potential design modifications are sent to product designer **120** to permit designers to consider potential design changes. In another example, design approval is provided to product designer **120** to indicate that the potential design can be manufactured. In another example, a yield analysis is provided to product designer **120** based on the product specified and the capabilities of manufacturers. In yet another example, a set of potential product manufacturers **140** whose equipment is

capable of producing the specified product is provided to product designer **120**. Method **400** ends.

FIG. 7 is a flow chart showing an alternate method **500** of performing a design rule check (an alternative embodiment to method **400**), whereby capability matrix table **320** is stored locally within client computers (**210a** and **210n**) for analysis process **310** and the validity of capability matrix table **320** is checked on a run-by-run basis, including the steps below.

In step 510, product designer **120** requests access to design rule checking applications from service provider **110**.

In decision step 520, a determination is made as to whether the system operator is an authorized user of the systems of service provider **110**. In one example, this authentication is done with conventional username and password authentication where a user logon form is transmitted to client computers (**210a** and **210n**) from design management host **230**. The combination of username and password is compared to the file of valid usernames and passwords stored in design management host **230**. If the username and password combination submitted by the system operator matches a known valid combination in design management host **230**, method **500** proceeds to step **530**. If the username password combination submitted by system operator cannot be found (e.g., after three attempts), method **500** ends.

In step 530, product designer **120** submits design data for design rule checking to ensure that the product specified can be manufactured. In one example, the product specification file is a CAD file. In another example, the product specification file is a structured data set. The product specification file is transmitted by network **220** and stored by design management host **230**, (e.g., in application server **234**) for subsequent analysis.

In decision step 533, the design rule checker queries design management host **230** to determine whether capability matrix table **320** resident within client computers (**210a** and **210n**) is current. If so, method **500** proceeds to step **550**. If not, method **500** proceeds to step **537**.

In step 537, the most current image of DRC capability matrix table **320** is transferred to analysis process **310** within client computers (**210a** and **210n**) via network **220**. This step ensures that the most current design rules and manufacturer information is available when a product design is checked.

In decision step 550, the design data submitted in step **530** is analyzed and compared to DRC capability matrix table **320** populated in step **537**. If the design data satisfies the conditions defined by the DRC capability matrix, method **500** proceeds to step **570**; if not, method **500** proceeds to step **560**.

In step 560, error details regarding product specifications are sent to product designer **120** from design management host **230** via network **220**. These error details are generated as a result of running the product design against the design rule checker. The error details that are sent to product designer **120** generally include information to permit product designer **120** to quickly find design errors and plainly identify the action necessary to correct them. In a more specific example, potential errors include issues related to any of the following areas, including but not limited to: DRC compilation, constraint violations, incomplete or incorrect definitions, incompatible device properties, incompatible layer properties, and syntax. Method **500** then ends.

In step 570, additional information regarding product specifications is sent from design management host **230** via network **220**. In one example, potential design modifications are sent to product designer **120** to permit designers to consider potential design changes. In another example, design approval is provided to product designer **120** to indicate that the potential design can be manufactured. In another example, a yield analysis is provided to product designer **120** based on the product specified and the capabilities of manufacturers. In yet another example, a set of potential product manufacturers **140** whose equipment is capable of producing the specified product is provided to product designer **120**. Method **500** then ends.

Methods **400** and **500** are just two examples of design analysis methods supported by the invention. Similar processes for design data conversion (e.g., converting CAD data to CAM/factory automation data) are supported. For

example, generation of raster images for the control of a laser thermal transfer process as described in commonly assigned U.S. Patent Application Serial No. __________ filed __________ by Andrea S. Rivers et al., entitled "__________", the disclosure of which is herein incorporated by reference, can be integrated by service provider **110** in such a way that guarantees that only valid and appropriate capability data is used to generate the raster images.

The invention has been described in detail with particular reference to certain preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

PARTS LIST

10	designer location
15	computer
20	design
25	modem
30	channel
35	channel
40	service provider location
45	computer
50	modem
55	computer
60	modem
65	radiation source
70	display manufacturing apparatus
75	connection
80	manufacturing location
100	system data flow
110	service provider
120	product designer
125	data
130	data
140	display product manufacturer
145	data
150	data
200	design management system topology
210a	client computer
210n	client computer
220	network
230	design management host

PARTS LIST (con't)

232	web server
234	application server
236	database server
300	software architecture
310	analysis process
315	design data analysis application
320	capability matrix table
330	conversion process
335	design data conversion application
340	capability matrix table
350	network
360	capability database
365	block
370	block
372	block
375	block
377	block
380	block
382	decision block
383	decision block
385	block
390	block
395	block
400	method
410	block
420	decision block
430	block

PARTS LIST (con't)

440	block
450	decision block
460	block
470	block
500	method
510	block
520	decision block
530	block
533	decision block
537	block
550	decision block
560	block
570	block